around it: this having been once satisfactorily made out, the building may *then* be a study of itself. Had this been done we might have avoided having consecutive buildings in all the most widely separated and unharmonising styles, disagreeable only from their juxtaposition: moreover, wherever great projections occur, the visual ray should be projected from the ordinary point of sight, and all ornament avoided within the angle it covers. From want of due reflection I have seen many cases of rich work being lost, and it is better to exaggerate the inclination of the visual ray, than to put in ornament as though the building could ever be seen in geometrical elevation.

J. B. W.

DRAIN LONDON AND PRESERVE THE THAMES.

"Vitales anras carpis?"

The continually recurring discussions in the public journals on the means of removing from the vicinity of the metropolis of the empire the daily increasing mass of sewage matter, and of turning it to some useful purpose, exhibits at once the importance of the question and the difficulty of its solution. The discharge of the sewers into the Thames, contaminating its otherwise useful waters, and filling the air with baneful exhalations, is deprecated by every one; and yet, strange to say, there appears to be no present prospect of the nuisance being got rid of except by the old channels.

By the present system of sewage the atmosphere is polluted, the public health endangered, and two good things of inestimable value utterly wasted—worse than wasted—they are rendered noxious! These are, the sewage matter, which ought to be so valuable, and the water of the Thames, which should be a blessing, instead of an object of loathing, to the metropolis. To seek an outlet elsewhere than in the Thames, the whole present system of sewage would have to be abandoned, all the work that has been done would be rendered useless, and new experiments, at the expense of hundreds of thousands, mayhap, of millions of pounds, would have to be made, and which might end in disappointment—in having to return to the river again, or, failing in their object, might render the metropolis so pestilential as to rapidly diminish the population now swarming in its busy streets and public places.

The fall of the ground and flow of the water are naturally in the direction of the river. The existing sewers all, or nearly all, ultimately discharge into it. To turn their course inland, and find a vent for them there, would be a labour far surpassing all the twelve for which Hercules was deified.

A scheme was some years ago proposed for the drainage of Dublin, and abandoned after some consideration. This is now brought forward, among others, as feasible for the same purpose in London. It consists, principally, in retaining the existing sewers, making them discharge into covered canals on both sides of the river, and running parallel with it. The expense of constructing such canals would be enormous, and the time required to complete them would necessarily be very great from the numerous natural and artificial obstacles to be contended with. When completed there arises the question:—Where are the canals themselves to be discharged? After absorbing the myriad of comparatively small nuisances, what is to be the destination of the monster accumulation of all that is abominable? Such canals, running parallel with the river, cannot have a considerable fall; there is consequently a risk of a stagnation of their poisonous contents. No ebb and flow will reach them, as is the case with the river, and carry off their impurities. In their whole length it is to be supposed they are to be air-tight, or, at least, that they are to be so constructed that their mephitic vapours may not ascend into the crowded dwellings of the city above. Moreover, these canals will be the debouchement of the sewers which will thus be shut out from inspection from below by an atmosphere to breathe which would be death. Bad as the sewers are which discharge into the Thames, they are, nevertheless, within the reach of inspection, and, by the aid of the tide, of flushing, and of mechanical agents, all collections of impurities and of noxious gases are quickly removed.

Such considerations are so important that they can hardly be exaggerated. It must be remembered that plague was once endemic in London; and that cholera, typhus, scarlatina, diarrhœa, and other epidemics which rage periodically at this day are attributed principally to imperfect sewage. It behoves the public to watch closely experiments of such vital importance, and to be certain that what is intended for improvement does not turn out an engine of mischief, increasing our present ills, and conjuring up those worse scourges from which our country has happily been many years free.

The frequent discussion of this subject, and its manifest importance, must have led almost every intelligent person, professional and unprofessional, to reflect on the subject. In doing so the writer has been reminded of the somewhat peculiar, but, nevertheless, efficient mode by which the Chinese have for ages not only avoided a great evil, but, with characteristic ingenuity, have converted it into a positive advantage. With a hot, damp climate, the best suited, perhaps, in the world for the propagation and retention of malaria, and a dense population of not over-cleanly habits, the cities of China are free from epidemics resulting from the want of proper sewage; and yet they all, like London, seek an outlet by the river, but not *into* it.

The Chinese know too well the vast reproductive value of manure, and have too great difficulty in supporting a teeming population to throw into the water that which can be so valuably disposed of on shore. At the quays of every city in China there may be seen at daylight in the morning a string of boats carrying on active traffic with long lines of porters, who arrive and depart with the industry and regularity of ants. Each porter, on his brawny shoulders, carries a bamboo, from each end of which is suspended a pail full of sewage matter. Bargains are rapidly made and the contents of the pails thrown into the tanks on board the boats, which, as they are filled, close their hatchways and move off to make room for others. So valuable is this trade considered, that considerable sums are paid by the boatmen for licences, and the porters even pay the housekeepers for the material which they remove, so that their portion of the profit is, probably, little more than the fair remuneration for their labour. Companies are established in the cities who find it a profitable investment to establish "*Inodores*," similar to those in France, but where every one is hospitably entertained without payment.

The sewage matter thus collected is taken to considerable distances, and materially assists in the production of the continuous crops which are taken from land in China, in rapid succession, without impairing its fertility.

The means I would suggest for the sewage of London are similar as regards the saving of the sewage matter, and in using the river as the channel by which it may be removed, carefully avoiding, however, any admixture of the two. Instead of making use of the shoulders of porters, London may safely venture to adopt other and more scientific means to arrive at the same results. The present sewers might continue to be the porters as far as the river, but when there let the sewage matter be discharged into receptacles prepared for the purpose. These receptacles should be shafts built of solid masonry, and lined with Seyssel asphalte: a flood-gate, or portcullis, would be required to connect the perpendicular shaft, used as a terminal receptacle, with a horizontal one into which the sewage-matter might be allowed to flow in sufficient quantities to permit of its being deodorised in twenty-four hours. Every night the deodorised mass might be removed, by the river, in tank-boats constructed for the purpose, to be used as manure, or to undergo, if necessary, a further and more complete process of deodorisation. By the adoption of this measure, the present sewers may be generally maintained, or, where they discharge inland, they may be conducted to a similar terminal receptacle at the side of the nearest canal or railway, by which the peat-charcoal, lime, and other deodorising substances may be conveyed, and the manure afterwards removed to the interior of the country.

It may be urged in objection to this scheme, that the sewers are the drains by which all the waste water of the metropolis is discharged into the river. This would deteriorate the sewage matter by diluting it, and, by greatly increasing its volume, there would also be required terminal receptacles of greater capacity than would be necessary if the surplus water could be otherwise disposed of. It would also necessitate a greater number of tank-boats, and larger quantities of peat charcoal, for the purpose of absorption as well as of deodorisation. A certain quantity of water would be requisite to carry off the impurities which would otherwise collect in the bottom of the sewers; the quantity necessary could only be ascertained by actual experiment; would be different in different localities, depending on the capacity and inclination of the sewers and the facilities with which the contents could be expelled; a smooth surface could be cleansed with less water than a rough and broken one; a sewer with a considerable fall, than one of more moderate inclination.

To furnish an adequate but not superabundant supply, the surplus rain-water would have to be discharged into the Thames by pipes, which might be conducted through the sewers, without any admixture of their contents taking place. A trap in connection with the street gutters would conduct the surplus water into the waste pipes, allowing, by a simple apparatus, any quantity necessary to be discharged into the body of the sewer to purify and cleanse it. It is probable that the refuse water from the houses, being impure and unfit to be mixed with the useful waters of the Thames, would suffice for this purpose; if not, a regulated occasional supply might be furnished through the gutter traps, as stated above.

The first thing necessary would be to ascertain by experiment the quantity of water requisite, the volume of the discharge, and the time necessary for deodorisation. If the volume of the discharge were found to be inconveniently great owing to the quantity of water used as a mechanical agent, it would become necessary to adopt a more expensive but greatly improved modification of this plan. This would mainly consist in constructing in each of the sewers,—besides the waste-water pipe to carry off the street drainage,—a pipe of about two feet in diameter as the passage by which all the sewage matter might be discharged. These pipes could, in ordinary situations, be kept clear by the impure refuse water from the houses, and, under the most disadvantageous circumstances, atmospheric pressure could be applied mechanically to almost any extent.

The pipes, being air-tight, would allow no effluvium to escape: they might, even, be disinfected periodically with chloride of lime and other chemical agents. The present sewers would thus be converted into underground passages, or tunnels, easily inspected and kept in order, and through which might be conducted not only waste water and sewage pipes, but also gas-pipes, electrical tubes, fresh-water pipes, and other apparatus, for which the streets are now so frequently torn up, and over which the inspection is necessarily imperfect. There is no reason why these passages might not be made as accessible and as convenient as the Thames Tunnel, and it would be quite possible to keep them well lighted, ventilated, and dried by the aid of gas.

The collateral advantages of this scheme need hardly be pointed out. Water and gas, from the ease of inspection and the facility afforded in laying and repairing the pipes, might be distributed more cheaply and more universally. For the requirement of electrical and scientific apparatus some such arrangement is indispensable to secure accuracy and certainty in carrying it through the metropolis. The waste rain water would be available for public fountains, baths, and washhouses. Gas factories and similar establishments might be compelled to use pipes and tanks of their own in connection with these channels, by which they might safely remove or devote to some useful purpose the deleterious refuse, with which they now poison both water and air, rendering, in some cases, the very sewage matter itself noxious to both vegetable and animal life. Accidents in all these important departments might be obviated by facility of inspection, while repairs, improvements, and alterations might be operated without inconvenience to the public.

All these extensive operations conducing to public convenience and well being would be cheapened and improved, many scientific observations would be facilitated and demonstrated, another proof would be exhibited to the world that we are not retrograding—that we are not even satisfied to be only as our fathers have been—that in the race of improvement we will not yet yield the first place. London underground might indeed become, as it has been incorrectly stated to be, almost as great a wonder as the city above.

It is unnecessary to enter at present on any of the details connected with this plan. I would, however, point out the advantage to be derived from *convict labour* in a work of this kind. The great body of the labourers would be required in the tank-boats, in working at the construction of the terminal receptacles at low-water mark, and in quarrying at Portland and elsewhere the stone of which they would be built. These, being extraordinary employments, would not compete unfairly with free labour; being public works, would be most economically and fairly carried out by the labour of those who are supported at the public expense: and there would be a retributive justice in extracting from the public enemies a real and lasting benefit to the common weal. The convict labourers might be lodged in hulks anchored near the scene of their operations. Their occupations being at a distance from the thoroughfares, they could be kept apart from the public, making them useful in their own sphere, without contaminating others by their presence and society. While mixing with their fellow-men, they are the professors and teachers of crime: when detected, they are a burden and expense: and they are a source of serious embarrassment when convicted. To send them to a depôt like Norfolk Island is to breed the most awful crimes arising from absolute idleness, while even the worst malefactor may be reclaimed by finding him employment.

The experiment, of which I have merely traced an outline, might be tried, in the first instance, in one or two localities, till the necessary experience had been obtained of its working, so as to apply it with the greatest advantage to the sewage of the whole metropolis as a system. There is no doubt also that more rapid and perfect deodorisation may be used than is now in practice, and which would tend to facilitate the working of this plan.

On the same system every town and village of the United Kingdom may find an innocious discharge for its impurities, and at the same time turn to account manure that is always so valuable, but which at this

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